

# **Initial Project Description Report**

Contract No. W9132T-04-C-0014

## **Proton Exchange Membrane (PEM) Fuel Cell Demonstration Of Domestically Produced PEM Fuel Cells in Military Facilities**

US Army Corps of Engineers  
Engineer Research and Development Center  
Construction Engineering Research Laboratory  
Broad Agency Announcement CERL-BAA-FY03

## **Flint Electric Membership Cooperation**

Luther H. Story Recreation Center Building 3308  
Sand Hill Area  
Fort Benning, Georgia

December 10, 2004

## Executive Summary

One PEM fuel cell will be used in this demonstration project at the Luther H. Story Recreation Center Building 3308 Fort Benning Georgia. The manufacturer of the fuel cell is Plug Power. The unit is rated as approximately 5 kilowatts and will be set to the 5.2 kilowatt set point for the duration of the test. The fuel cell will use natural gas as a stock and will be grid connected. The heat byproduct will be captured and used to produce domestic hot water. The building to which the fuel cell will provide AC electrical energy is used as a recreational building for Army recruits assigned to the Sand Hill Area. The energy provided by the fuel cell will be only a fraction of that required by the building. Of interest in this project will be the capture of waste heat to provide hot water to the building and the availability of the unit for producing energy. The unit has some standby capabilities but these will not be used. Contract award for this demonstration is \$160,514.00. The host site individual is Chuck Ivey, Resource Efficiency Manager, Fort Benning whose e-mail address is [charles.ivey@benning.army.mil](mailto:charles.ivey@benning.army.mil). His office phone is (706) 545-0922. His cell phone is (678) 637-1636.

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# **Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities**

## **1.0 Descriptive Title**

A one year demonstration project utilizing a fuel cell unit at Fort Benning Georgia.

## **2.0 Name, Address and Related Company Information**

Flint Electric Membership Cooperation  
103 South Macon Street PO Box 308  
Reynolds, Georgia 31076-0308  
(478) 988-3551  
DUNS number: 00692-6349  
Cage Code: OJWD8  
Taxpayer Identification Number: 0580456574

Flint Energies is a non profit electrical distribution cooperative which serves a 16 county area of Georgia with dependable electric service. We are owned by our members and governed by an elected board of directors.

## **3.0 Production Capability of the Manufacturer**

The fuel cell manufacturer for this demonstration is Plug Power, 968 Albany Shaker Road, Latham, New York 12110. Richard Romer whose e-mail address is [richardromer@plugpower.com](mailto:richardromer@plugpower.com), telephone number 518-782-7700 x 1984. As of January 2005 Plug Power has installed over 130 fully integrated fuel cells operating in field demonstrations. A GenSys 5CS unit has been purchased and is in Flint's possession.

## **4.0 Principal Investigator(s)**

Name: Larry Pearce  
Title: Vice President of Transportation and Materials Management  
Company: Flint Electric Membership Cooperation  
Phone: (478) 988-3551  
Fax: (478) 988-3559  
e-mail: [lpearce@flintemc.com](mailto:lpearce@flintemc.com)

## **5.0 Authorized Negotiator(s)**

Name: Larry Pearce

Name: Robert Ray Jr.  
Title: President/CEO  
Company: Flint Electric Membership Cooperation  
Phone: (478) 847-5101  
Fax: (478) 847-5173  
Email: [bray@flintemc.com](mailto:bray@flintemc.com)

#### 6.0 Past Relevant Performance Information

Flint has successfully hosted a Plug Power fuel cell at our operating headquarters in Warner Robins, Georgia since June 2002. We have a distribution agreement with GE to distribute Plug PEM fuel cell products in 100 counties of Georgia. We have 5 trained fuel cell technicians employed at Flint.

POC: Larry Pearce  
VP Flint EMC  
Phone (478) 988-3551  
Fax (478) 988-3551

#### 7.0 Host Facility Information



Figure 1

Point of Contact at Ft Benning will be Mark Fincher, Installation Facilities Officer, phone (706) 545-7928, e-mail [markfincher@benning.army.mil](mailto:markfincher@benning.army.mil)

Local POC is Chuck Ivey Cell phone (678) 637-1636 [charles.ivey@benning.army.mil](mailto:charles.ivey@benning.army.mil) Office (706) 545-0922

The Luther H Story Recreation Center is located in the Sand Hill Area of Fort Benning. It is used as a recreational center for Army recruits.

## 8.0 Fuel Cell Site Information

Flint Electric Membership owns and maintains the electrical facilities on post. No permitting will be required. Natural Gas is supplied by ATMOS energy. Communication lines are Southern Bell.

Location of the fuel cell will be on the north side and close to the mechanical room of building 3308 as shown on figure \_\_. There is a panel mounted on the outside wall of the mechanical room. This panel was installed to feed the exterior lighting for the building. We will feed power from the unit into this panel. The unit will be feeding the grid, and no attempt has been made to feed emergency power in case of grid failure. This fuel cell is capable of stand-alone operation, but this feature was not considered for this demonstration.

The unit will be a GenSys 5KWe unit. The unit will be operated at 2.5KW for the duration of the demonstration.

A source of natural gas is readily available, as are water, drains and communication lines inside the mechanical room..

NEMA 4 boxes will be mounted on a rack to house the necessary disconnect switch, as well as external metering apparatus.

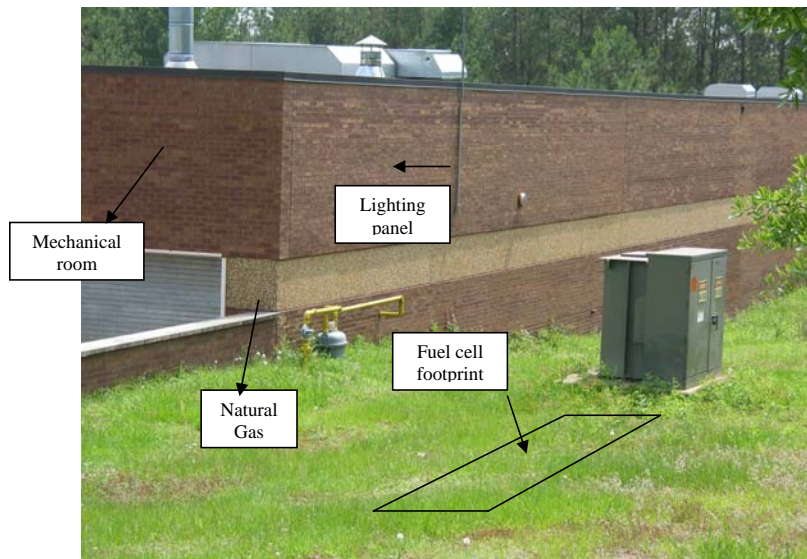


Figure 2  
The fuel cell will be approximately 14' from the building



Figure 3  
Metering and disconnect mounted on rack. An exact replica will be mounted beside fuel cell



Figure 5  
Pictured above is the de-ionized water system and monitor and modem. The same arrangement will be mounted inside the mechanical room.

The fuel cell will provide 2.5 kilowatts of power over the operating period of the demonstration , at 120 volts AC output. The unit will be connected directly to the grid owned and operated by Flint Electric Membership Cooperation, through the building's electrical service entrance. No specific loads have been designated to be exclusively supplied by the fuel cell. No permits are anticipated as Flint owns and operates the electrical system. The heat recovered from the fuel cell will be used to provide a portion of the domestic hot water for the building.

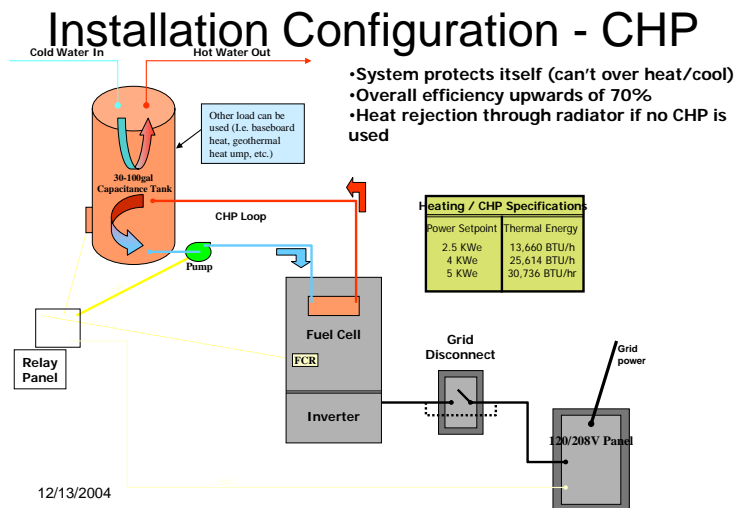
10.0 Thermal Recovery System

Figure 6

This demonstration contains a thermal recovery system. The cold water goes into the unit and picks up heat from the heat exchanger and the hot water flows into the hot water storage tank. The minimal thermal energy output of 3270W, 6400W, and 6700W should be expected for 2.5, 4, and 5KW set-points respectively. The heat recovery Liquid Operating Pressure Range is 0-30 PSIG. The Heat Recovery Liquid Temperature Range is 32 degrees F to 140 degrees F. The expected Heat Recovery Liquid Flow Range is 0 to 10 GPM. The overall efficiency of the unit with CHP is 60% at 5kW, 65% at 4kW, and 55% at 5kW.

#### 11.0 Data Acquisition System

The data connection is via a modem and a dedicated telephone line. Operation of the unit (changes in operating points) is accomplished through the connection of a desktop computer located in the mechanical room running the manufacturer's Technician Software. The unit will automatically transfer "System Log Files" to the manufacturer on a daily basis, and transfer error files in the event of a shutdown. In the event of a shutdown an alarm will be sent via modem to the Flint operations center in Warner Robins, GA from which a technician will be dispatched. Plug Power will collect the data in Latham, NY and send a copy of the data to Flint on a weekly basis.

As a minimum, the parameters which shall be monitored include total operating hours, fuel input, total kW hours (kWh) produced, availability, outages and duration (start/stop events with associated dates and times), maximum kW produced, outdoor ambient temperature, and total heat recovered. Data from the above parameters shall be collected on intervals of one hour or less. Raw data shall be submitted monthly.

#### 12.0 Economic Analysis

Electric energy rate (Georgia Power Company)      \$.053604/kWh

1 Therm = 29.31 kWh

Gas energy rate (ATMOS Energy)                      \$.70/Therm

Output at 90% availability:  $2.5\text{kW} * 8760 \text{ hours per year} * 0.90 = 19710 \text{ kWh}$

**Output savings per year:  $19,710 \text{ kWh} * \$0.053604 = \$1,056$**

Plug Power reported efficiency at 2.5 kW: 60% with (CHP)

Input at 90% availability (kWh):  $19710 \text{ kWh} / 0.60 = 32,850\text{kWh}$

Input at 90% availability (Therms):  $32,850\text{kWh} * 1 \text{ therm} / 29.31\text{kWh} = 1,116.90 \text{ Therms}$

**Input cost per year:  $1,116.9 \text{ Therms} * \$0.70 / \text{Therm} = \$781.83$**

**NET ANNUAL ENERGY COST DIFFERENCE:**

**$\$1,056.53 - \$781.83 = \$275.70$**



13.0 Kickoff Meeting Information

Kickoff meeting was held February 16, 2005

Present: Larry Pearce, Ronnie Sanders, Mike Branham, Jim Adkinson, David Stephens (Flint)

Melissa White, CERL

Chuck Ivey, Ft Benning

Project installation was discussed. Methods of installing water, gas and electric and communication lines were determined.

Reporting timeline was agreed upon.

14.0 Status/Timeline

Fuel Cell Available	Flint office on Ft Benning now
Fuel Cell Installation	Within 1 month
Initial Project Description Report	February 22, 2005
Monthly Operating Report	Submitted on a monthly basis for the duration of the project (submission to commence within 30 days after fuel cell installation)
Midpoint Project Status	Within 2 months after installation of fuel cell
Fuel Cell Removal	After 12 months ( or longer if needed) where the cell has exhibited at least 90% availability during operating period
Site Restoration	Within 1-2 weeks of conclusion of project
Final Report (Draft)	Within 2 months after the end of the demonstration project
Final Report (With Comments)	Within 30 days of receipt of ERDC/CERL draft report comments